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Review article

A systematic review of studies that included both measures of physical activity and sedentary behaviour in older adults

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ABSTRACT

Objective: The main aim of this study is to identify, appraise and synthesize evidence on the level of physical activity and sedentary behavior in older adults.
Method: This review was restricted to studies published between January 2006 and January 2019 and included studies that reported physical activity and sedentary behavior in older adults (≥65 years old) without chronical health conditions.
Results: Twenty studies met the inclusion criteria. Two studies reported data for older adults residing at assisted care facilities, showing results of moderate to vigorous physical activity much lower than those reported in studies with older adults living in the community (2 min/per day and 37.2 min/per day, respectively).
Conclusion: Sedentary behavior is high in the elderly, with men presenting higher values than women. moderate to vigorous physical activity has very low values, and with the advancing age there is a decrease in the same.
Keywords: Exercise; Aged; Sedentary behavior.

Revisión sistemática de estudios que incluyen mediciones de actividad física y conductas sedentarias en ancianos

RESUMEN

Objetivo: El principal objetivo de este estudio es identificar, evaluar y sintetizar evidencias sobre el nivel de actividad física y comportamiento sedentario en mayores.
Método: Esta revisión fue restringida a estudios publicados entre enero de 2006 y enero de 2019, incluyendo estudios que incluyeron actividad física y comportamiento sedentario en personas mayores (≥65 años de edad) sin condiciones crónicas de enfermedad.
Resultados: Veinte estudios cumplieron los criterios de inclusión. Dos estudios reportaron datos para personas mayores institucionalizadas, mostrando resultados de actividad física moderada a vigorosa muy inferiores a los reportados en estudios con personas mayores que viven en la comunidad (2 min/día y 37,2 min / día, respectivamente).
Conclusión: El comportamiento sedentario es elevado en las personas mayores, los hombres presentan valores más altos que las mujeres. La actividad física moderada a vigorosa presenta valores muy bajos, siendo que con el avance de la edad se produzca una disminución.
Palabras clave: Ejercicio; Envejecimiento; Comportamiento sedentario.

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Uma revisão sistemática de estudos que incluem ambas as medidas de atividade física e comportamento sedentário em pessoas idosas

RESUMO

Objetivo: O principal objetivo deste estudo é identificar, avaliar e sintetizar evidências sobre o nível de atividade física e comportamento sedentário em pessoas idosas.

Método: Esta revisão foi restrita a estudos publicados entre janeiro de 2006 e janeiro de 2019, e incluiu estudos que relataram atividade física e comportamento sedentário em pessoas idosas (≥65 anos de idade) sem condições crônicas de saúde.

Resultados: Vinte estudos preencheram os critérios de inclusão. Apenas dois estudos relataram dados para pessoas idosas institucionalizadas, mostrando resultados de atividade física moderada a vigorosa muito inferiores aos relatados em estudos com pessoas idosas que vivem na comunidade (2 min/dia e 37,2 min/por dia, respetivamente

Conclusão: O comportamento sedentário é elevado nas pessoas idosas, sendo que os homens apresentam valores mais altos do que as mulheres. A atividade física moderada a vigorosa apresenta valores muito baixos, sendo que com o avançar da idade há uma diminuição da mesma.

Palavras-chave: Exercício; Envelhecimento; Comportamento sedentário.

Introduction

Over the last decades, the number of older persons has increased substantially in most countries. Demographic projections point to continuity of this growth in the coming decades.[1]

With the aging of the population and with the constant change in its lifestyle, the older people are increasing their sedentary behavior (SB).[2]

As mentioned above, increasing of daily sedentary time is associated with ageing.[3] According to current data, older adults spend approximately 60% to 70% of time in SB.[4] With the increment of total physical activity (PA) the risk of losing functional independence may decrease about 30%.[5] Thus, it is well known that PA is a powerful indicator of health and its benefits are well defined. On the other hand, physical inactivity is considered to be the fourth most important risk factor for global mortality.[6]

In the last decade, SB has also gained increased importance due to its relationship with the health of the elderly. Sedentary behavior is associated with several pathologies, as heart disease, stroke,[6] obesity, cancer, metabolic syndrome and type 2 diabetes.[2] It is important to note that SB could be an important determinant of health, independently of PA[7] and also that an increase of moderate to vigorous physical activity (MVPA) does not necessary imply less SB.[8] Unfortunately, most studies examined only PA or SB and therefore does not provided an overall picture of the motor behavior patterns of the elderly. In this context, the main aim of this study is to identify, appraise and synthesize evidence on the level of PA and SB in older adults. Moreover, we intend to compare the SB and PA levels between older adults living in the community and living in nursing home residences, as well as to verify the age and gender effects on SB and PA.

Methods

Search Strategy and data sources

The authors conducted an electronic searching on January 2019. This systematic review included studies from January 2006 – January 2019, by searching on the following databases: PubMed, MEDLINE, Science Direct, CINAHL, SPORTDiscus and MedicLatina. Electronic searches of computerized databases were carried out in English, Portuguese and Spanish.

The keywords used were "older adults" OR "elderly" AND "physical activity" OR "sedentary behavior" OR "sedentary behaviour" AND "levels" OR "patterns" OR "habits" OR "prevalence" AND "questionnaire" OR "accelerom*" OR "self report" OR "diary". These keywords were searched for in the articles' title or abstract.

Inclusion Criteria

Studies were included in this review if they met the following criteria: (1) reported both PA and SB for older adults (aged 65 years and over); (2) evaluated PA and SB using objective based measures (OBM) (e.g., accelerometer) or self-report questionnaire (SRQ); (3) included exclusively participants withthout chronical health conditions\disabilities (e.g., dementia, severe mental disease and diabetes; for articles that included individuals with and without disabilities, we only extract data for the latter). Data extraction was completed by two independent reviewers (SF, AR) that read all the abstracts and classified them as excluded or potentially included. The reviewers were based on the inclusion criteria. A third reviewer (JM) mediated any disagreements at each stage. Reviewers applied the inclusion criteria after reading the potentially included studies. When an article satisfied all eligibility criteria for both of the reviewers, it was included in the study. All three researchers contributed to the synthesis of the data.

Critical appraisal of the included studies

Research quality was assessed by a critical appraisal tool that was developed to suit the purpose of the selected studies and taken into consideration previous published tools.[9,10] The check list included 11 key items for studies that used objective based measures and 9 key items for studies that used self-report questionnaires (table 1). The score provided for each item, included a positive (+; criterion met), negative (-; criterion not met) or interrogative (?; study provided insufficient details).

Table 1. Standardized checklist for the assessment of methodological quality

Study objective		
1	Positive if a specific, clearly stated objective was described	OBM/SRQ
2	Positive if the study of physical activity / sedentary behavior was the main objective of the study	OBM/SRQ
Study population		
3	Positive if the main features of the study population were described (sampling frame and distribution of the population by age and sex)	OBM/SRQ
4	Positive if the inclusion / exclusion criteria were defined	OBM/SRQ
5	Positive if participation rate was reported	OBM/SRQ
6	Positive if the number of participants who met the criteria for using the accelerometer was indicated	OBM
7	Positive if the study provided a summary of the differences between those who participated and those who did not	OBM/SRQ
Method/Results		
8	Positive if the study clearly defined the unity of measure of physical activity (min / hours / counts)	OBM/SRQ
9	Positive if participants used an accelerometer ≥ 600 minutes for ≥ 3	OBM
10	Positive if physical activity was calculated by objective based measures	OBM/SRQ
11	Positive if more than one type of physical activity was assessed: LIPA and MVPA	OBM/SRQ

OBM: Objective based measures; SRQ: Self-report questionnaire; LIPA: light physical activity; MVPA: moderate-vigorous physical activity.

Results

Study selection

In total, 1597 articles were found, of which 792 were duplicates and 688 abstracts did not match the inclusion criteria. From the remaining 115 articles, 95 studies were excluded because not all participants were 65 years of age or over (n=30), do not report any PA and SB data (n=64), or only the abstract was available (n=1). In summary, a total of 20 studies were selected and included and a total of 1577 studies were excluded for this review (Figure 1).
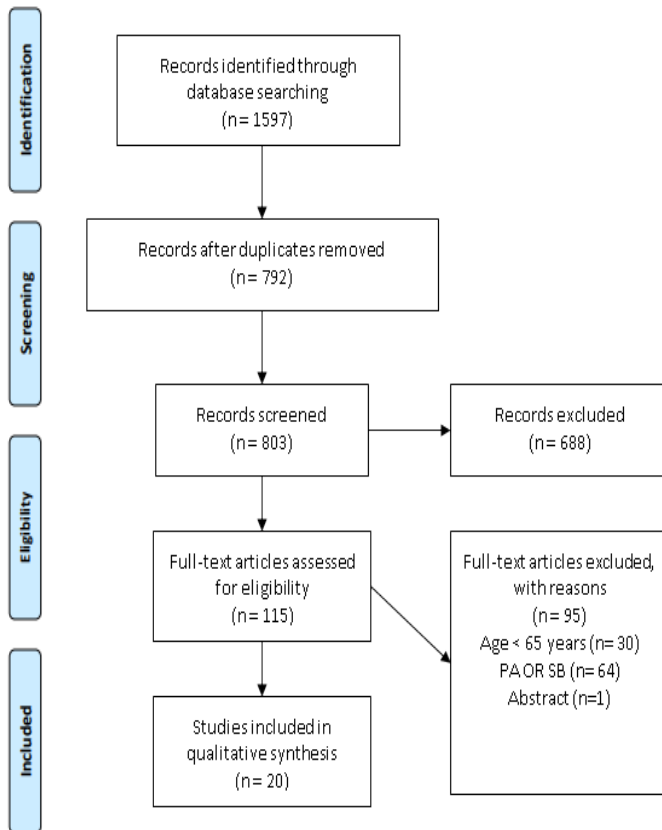

Figure 1. Flow diagram of studies search and selection.

Quality of studies included

Two studies calculated PA by self-report questionnaire and eighteen by OBM. Only 4 studies[11-14] met all quality criteria. Twelve studies[15-26] scored between 8 and 10 and four[27-30] studies scored between 4 and 7. All studies complied with the inclusion/exclusion criteria, although the majority of studies did not provide a summary of the differences between those who participated and those who did not. Most studies provided data on both light and MVPA and the majority of the studies that used OBM reported data for participants that used an accelerometer ≥ 600 minutes for ≥ 3 days.

Study and participants' characteristics

The studies included in this review were cross sectional studies (n=17),[11,15-23,25-30] cohort studies (n=2)[12,13] and prospective study (n=1).[24] They were conducted in Europe (United Kingdom, n=3; Portugal, n=2; German, Island, Norway, and Deutschland, all n=1),

Australia (n=1), North America (USA n=5, Canada, n=2), Brazil (n=1), and Japan (n=1) (Table 2). Participants of eighteen studies were living in the community and of two study were residing at assisted care facilities. All participants were 65 years of age or over.

Physical activity was measured by accelerometer which was used on the hip (N=17)[11-16,19-26,29-31] or arm (N=1),[18] and by questionnaire (International Physical Activity Questionnaire – IPAQ, n=1;[27] "45 and UP Study Questionnaire", n=1.[28]

Across the 20 studies there were 106418 participants and the sample size ranged from 9 to 91375 participants. The studies that use OBM (n=18) included 13839 participants, and the studies that use SRQ (n=2) included 92579 participants.

Objective based measures

The 18 studies with OBM, used different accelerometer models and the number of days and hours were also different (Table 2). The Actigraph accelerometer was used in 15 studies, Active Style Pro in 2 studies and body media in one study.

One of the studies[23] did not provide information about the number of days that the participants were asked to use the accelerometer, but only referred to the minimum number of days of accelerometer use that was required for data analysis. One study in particular,[36] asked the participants to use the accelerometer during a number of days (14-21 days) significantly higher in comparison with the other studies. In the majority of studies, the participants used an accelerometer during at least 10 hours per day (n=14). In the remaining 4 studies the participants used the accelerometer during 24 hours,[18] 8 hours[25,30] and 6h30min,[22] respectively. The criteria used in the reviewed studies for the measurement of PA are showed in table 3.

Physical activity and sedentary behavior

Fifteen studies reported PA and SB data in hours. Three studies reported data in percentage of accelerometer wear time, and 2 studies reported as meeting (PA ≥ 150 min per week) or not meeting PA health guidelines.

From the 15 studies that reported absolute values, 11 measured SB, light intensity physical activity (LIPA) and MVPA, 1 study[20] measured the SB, LIPA and total physical activity (TPA), 1 study[23] measured the SB and MVPA, and 2 study[25,30] measured the SB, LIPA, MVPA and TPA. Only 4 studies[12,13,18,24] meet with the international health recommendations for PA. On average the studies reported 29.45, 186.77, 623.6 min per day of MVPA, LIPA and SB, respectively.

Studies that reported results[16,19,27] in percentage of time in the targeted behavior, showed identical results of LIPA (30%; 32%; 49%). Two studies[16,19] reported very low MVPA (values below 1% of accelerometer wear time) and a high percentage of time (69% and 65%, respectively) in SB.

Studies that use a SRQ used self-administrated questionnaires (45 and UP)[28] and interview questionnaire (IPAQ).[27] In the Yorston[28] study, 73.6% of participants meet guidelines of MVPA, while in Guedes[27] study participants report that spend 19.45% of the day in MVPA.

Figure 2 shows 9 studies that reported PA by gender. All these studies reported SB and eight studies reported LIPA and MVPA. Men spent more time on MVPA (n=24.9 min) and SB (n=584 min) than women (MVPA, n=21.6 min; SB, n= 556.6 min). Women showed more LIPA (n=212.8 min) than men (n=180.9 min).

Figure 3 show 3 studies that reported PA by age groups. Studies divided the samples into two or three age groups from these: 65-69 years, 70-75 years, 75-79 years, 80-84 years, +85 years. The oldest (+85) were the group with the lowest level of activity.

Table 2. Details of the included studies

Study	Location and study setting	Design	Subjects	Instrument of measure	Physical activity and sedentary behavior results	PA Criteria
Davis et al., 2011	United Kingdom community-dwelling	Cross-sectional	>70 years N=230; ♀=113; ♂=117	Accelerometer	SB=604 min/day LIPA=165 min/day MVPA=18,45 min /day	SB<100 counts/min LIPA=100-1951 counts/min MVPA≥1952 counts/min
Batista et al., 2011	Portugal Community-dwelling	Cross-sectional	>65 years N=679 ♀=411 ♂=268	Accelerometer	SB=666 min/day LIPA=209.8 min/day MVPA=26.85 min /day	SB<100 counts/min LIPA=100-2019 counts/min Moderate=2020-5998 counts/min Vigorous≥5999 counts/min
Arnadottir et al., 2013	Iceland Community-dwelling	Cross-sectional	>73 years N=579 ♀=358 ♂=221	Accelerometer	SB=615min/day LIPA=200.5min/day MVPA=7.45min/day	SB<100 counts/min LIPA=100-759 counts/min MVPA≥2020 counts/min
Jefferis et al., 2014	United Kingdom Community-dwelling	Cohort	>70 years N=2450; ♀=857; ♂=1593	Accelerometer	SB=609min/day LIPA=203min/day MVPA=36min/day	SB<100 counts/min LIPA=100-1040 counts/min MVPA≥1040 counts/min
Lohne-Seiler et al., 2014	Norway community-dwelling	Cross-sectional	>65 years N=560; ♀=282; ♂=278	Accelerometer	SB=562.5 min/day LIPA=54.75 min/day MVPA=23.5 min/day	SB< 100counts/min LIPA=100-759 counts/min MVPA≥2020 counts/min
Madden et al., 2014	Canada community-dwelling	Cross-sectional	>65 years N= 51; ♀=27; ♂=24	Accelerometer	SB=1046.0 ± 13.1 min/day LIPA=235.8 ± 10.0 min/day MVPA=155.9 ± 11.4 min/day	SB< 100counts/min LIPA=100-1951 counts/min MVPA≥1952 counts/min
Bann et al., 2015	USA community dwelling	Cross-sectional	>70 years N=1130	Accelerometer	SB=648.55 min/day LIPA=185.35 min/day Total PA=185 min/day	SB< 100 counts/min LIPA=100-1040 counts/min MVPA=1041 -1951 counts/min
Chen et al., 2015	Japan community-dwelling	Prospective	>65 years N=1739; ♀=1079; ♂=660	Accelerometer	SB=451.6 ± 122.4 min/day LIPA=332.5 ± 98.1 min/day MVPA=37.8 min/day	SB ≤1.5 METs LIPA=1.6-2.9 METs MVPA≥3 METs
Jansen et al., 2015	Netherlands community-dwelling	Cross-sectional	>65 years N=74; ♀=32 ♂=42	Accelerometer	SB=595.93 ± 112.98 min/day LIPA=107.29 ± 56.27 min/day MVPA=1.49 ± 3.5min/day	SB≤50 counts/min LIPA=51-759 counts/min Moderate=760-1951 counts/min Vigorous≥1952 counts/min
Sartini et al., 2015	United Kingdom community dwelling	Cohort	>71 years N=1455 ♂=1455	Accelerometer	SB=619 min/day LIPA=197 min/day MVPA=39 min/day	SB<100 counts/min LIPA=100-1040 counts/min MVPA≥1040 counts/min
Takagi et al., 2015	Japan community dwelling	Cross-sectional	>65 years N=106; ♀=62; ♂=44	Accelerometer	SB=709.9 ± 107.6 min/day LIPA=338.25 min/day MVPA=26.7 min/day Total PA=730.1 ± 107.6 min/day	SB< 1 METs LIPA=1.0-2.9 METs MVPA ≥ 3 METs
Corcoran et al., 2016	USA Residing at assisted care facilities	Cross-sectional	>65 years N=65; ♀=9 ♂=56	Accelerometer	SB=665.2 ± 114.9 min/day LIPA=127.7 ± 51.5 min/day MVPA=1.6 ± 2.26 min/day	SB≤ 100 counts/min LIPA=101-759 counts/min MVPA≥ 2020 counts/min
Gennuso et al., 2016	USA community dwelling	Cross-sectional	>65 years N=44; ♀=28 ♂=16	Accelerometer ActivePAL	SB=558 min/day MVPA=17.8 min/day	SB< 100 counts/min LIPA=100-760 counts/min Moderate=760-5725 counts/min Vigorous≥ 2020 counts/min
Chastin et al., 2014	USA Community-dwelling	Cross-sectional	>70 years N=2635	Accelerometer	SB=69.2 % LIPA=30 % MVPA=0.8%	SB< 100 counts/min LIPA=100-1951 counts/min MVPA=1952-5724 counts/min
Ortlieb et al., 2014	Germany community-dwelling	Cross-sectional	>65 years N=168; ♀=78; ♂=90	Accelerometer	SB=65% LIPA=32 % MVPA=0.3%	SB≤ 100 counts/min LIPA=101-1951 counts/min MVPA≥ 1952 counts/min
Guedes et al., 2011	Brazil Community-dwelling	Cross-sectional	>70 years N=1204; ♀=645; ♂=559	Questionnaire IPAQ	SB=30.725 % LIPA=49.825% MVPA=19.45%	SB< 600Met-min/week Active≥ 600Met-min/week Very Active≥ 3000Met-min/week
Gennuso et al., 2013	USA Community-dwelling	Cross-sectional	>65 years N=1914	Accelerometer	Meeting guidelines–35.1% Not meeting guidelines–64.9%	SB< 100 counts/min LIPA=101-759 counts/min MVPA≥ 1952 counts/min
Yorston et al., 2012	Australia community-dwelling	Cross-sectional	>65 years N=91375	Questionnaire	Meeting guidelines –73.6% Not meeting guidelines–26.4%	
Tong et al. 2018	Canada Community-dwelling	Cross-sectional	>65 years N=46	Accelerometer	SB=400.2 ± 51 min/day LIPA=142.8 ± 39.84 min/day MVPA=18.30 ± 15.48 min/day	SB< 150 counts/min LIPA=150-499 counts/min MVPA=500-3999 counts/min
Marmeleira et al. 2017	Portugal Nursing home residences	Cross-sectional	>65 years N=9	Accelerometer	SB=603.7 ± 79.9 min/day LIPA=115.0 ± 47.4 min/day MVPA=2.3 ± 1.4 min/day	SB< 100 counts/min LIPA=100-2019 counts/min Moderate=2020-5998 counts/min

SB: sedentary behavior; LIPA: light physical activity; MVPA: moderate vigorous physical activity; ♀: Female; ♂: Male.
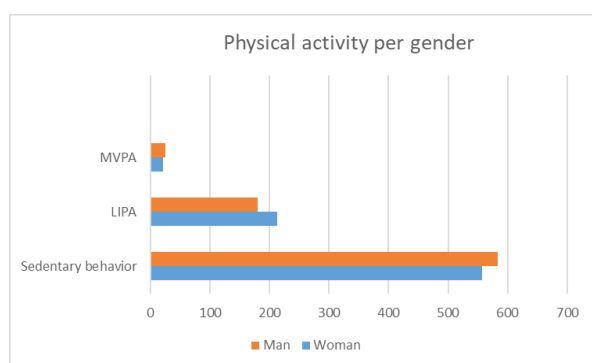

Figure 2. Physical activity (min per day) per gender. LIPA: light physical activity; MVPA: moderate-vigorous physical activity.
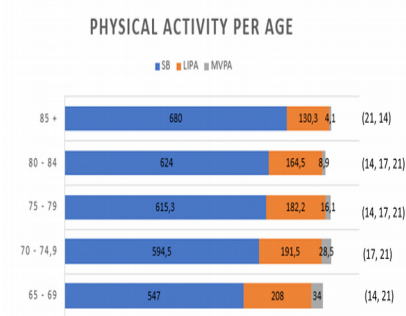

Figure 3. Physical activity according to the studies data per age groups (results represent the average of the cited studies). SB: sedentary behavior; LIPA: light physical activity.

Table 3 - Physical activity studies which used OBM

Studies	Accelerometer	Number of hours per day	Number of days 1	Period selection (days) 2
Davis et al., 2011	ActiGraph	10h	7	5
Batista et al., 2011	ActiGraph	10h	4	3
Arnardottir et al., 2013	Actigraph	10h	7	4
Gennuso et al., 2013	ActiGraph	10h	7	1
Chastin et al., 2014	Actigraph	10h	7	5
Jefferis et al., 2014	Actigraph	10h	7	3
Lohne-Seiler et al., 2014	ActiGraph	10h	7	4
Madden et al., 2014	Sensewear Pro arm (Body Media)	24h	7	5
Ortlieb et al., 2014	Actigraph	10h	7	4
Bann et al., 2015	Actigraph	10h	7	3
Chen et al., 2015	Active style Pro HJA-350IT	10h	7	4
Jansen et al., 2015	ActiGraph	6h30m	7	3
Sartini et al., 2015	Actigraph	10h	7	3
Takagi et al., 2015	Active Style Pro HJA-350IT	8h	14 -21	7
Corcoran et al., 2016	Actigraph	10h	10	3
Gennuso et al., 2016	Actigraph	10h	-	3
Marmeleira et al., 2017	Actigraph	8h	7	3
Tong et al., 2018	Actigraph	10h	7	6

Number of days: number of days that each participant use the accelerometer; Period selection: valid days defined by researchers.

Discussion

To define strategies to promote an active lifestyle for the elderly, it is important to understand their daily activity. In this way, it becomes imperative to know the daily levels of PA and SB of this population, for developing guidelines that counteract the functional decline associated with aging and prevent various diseases associated with advancing age. Sedentary behavior increases significantly with aging, with the older adults spending more than 60% of the day seated.[32] SB is associated with increased mortality, obesity, functional ability, metabolic syndrome, cardiometabolic disease, and falls.[7,29,33,34] Thus, this review intended to synthesize current information about PA levels and SB in older people living in the community or in nursing home residents.

From the 20 studies included in this review, 18 studies collected the values of PA and SB through accelerometry. The accelerometer was used for at least 4 days in all studies, though the minimum number of hours per day that the device was used ranged from 6.30 to 24 hours. Only in one study the participants used the accelerometer for 24 hours,[18] being that the participants in the other studies only used the accelerometer in daytime. In the study of Madden[35] the average daily MVPA values were much higher (MVPA = 155.9 min/day) than in the remaining studies (MVPA = 21.22 min/day).

The studies used different OBM for collecting PA and SB data, namely Actigraph, Active style pro-and sensewear pro armband, although the former was the most frequent. There was a similarity in the PA intensity between most studies, excepting the study of Madden et al.[18] which reported very high levels of PA intensity. One should note that this study was the only one where the accelerometer was placed at the arm of the participants (all the others used the accelerometer at the hip).

There was a pronounced difference between some studies in the proportion of elderly people meeting the PA recommendations for health. Yorston et al.[28] reported that 73.6% of the older adults met the PA minimum recommendation of 150 min per week of MVPA, which contrasts with the 35.1% of older adults meeting the same recommendation in the study of Gennuso et al.[29]. It is important to note that the first study used a SRQ to evaluate the PA levels, hence the second study used an OBM (accelerometry) for that propose. Thus, it seems that participants tend to indicate more PA than they actually practice when the questionnaire is used as screening tool.[28,29] These results are consistent with other studies with adults, that showed that the time in PA measured by the accelerometer is smaller than those estimated by the IPAQ.[31] Other study with fibromyalgia patients also showed that the participants over-estimated PA levels with the IPAQ.[32]

Three studies reported the data in percentage:[16,19,27] Chastin et al.[16] and Ortlieb et al.[19] used an OBM (accelerometer) and Guedes et al.[27] used a SRQ (IPAQ). All these studies evaluated SB and MVPA. Guedes[27] reported that in average each person spent per day 30.7% of the accelerometer wear time in SB and 19.5% in MVPA. The results of Chastin et al. and Ortlieb et al.[16,19] do not corroborate such findings, since they reported that the participants spent over 60% of the accelerometer wear time SB and less than 1% in MVPA. Once more, the PA results may reflect the use of different methods for collecting activity data, since a questionnaire is a much more subjective measure and, has stated before, there is an overvaluation of the person about his daily behavior.

The study of Corcoran et al.[15] and Marmeleira et al.[25] were the only one that evaluated older adults residing in assisted care facilities. These studies reported that an average of 2 min per day was spent on MVPA, while other studies which reported quantitative values for older adults living in the community, indicated a mean MVPA of 37.18 min per day. Four studies[14,15,22,25] showed very low values of MVPA, not exceeding 10 min per day. From the 15 studies that reported absolute values of PA and SB, only 4 studies[12,13,18,24] showed that participant spent in average more than 30 min of MVPA per day, which corresponds to the international recommendation of PA. Nine studies[11,12,14,20,21,23,24,26,31] compared activity data between genders. Women spent more time in LIPA (LIPA=212.8 min/per day) than men (LIPA=180.9 min/per day). On the other hand, women spent less time in MVPA than men (21.6 and 24.9 min per day of MVPA, respectively). Finally, men spent more time in SB (men=584 min per day and woman=556.6 min per day).

Some studies compared the activity levels between age groups above 65 years. There was a progressive decrease of LIPA and MVPA from the 65-69 years group to the +85 years group. On the other hand, SB increased progressively with age, being the oldest group (+85 years) the most sedentary.

This article has a number of limitations. The criteria for defining SB, LIPA and MVPA were different between some studies. Also, there are a limited number of available studies with older adults (≥65 years) measuring both SB and PA levels, especially in institutionalized settings. Few studies examined the difference between genders and age groups in SB, LIPA and MVPA.

Conclusion

This revision shows that SB is very high and MVPA is very low in older adults. Considering that both SB and MVPA are independently associated with health and well-being, this could have negative consequence for the older adults' health and functional capacity.

The studies that used self-report questionnaires showed better results of MVPA than those that used OBM. Moreover, in the studies that used SRM, it seems that there is an overestimation of PA, which increases when the questionnaires are self-administered.

There is some evidence that older adults living in the community are more active than older adults residing in assisted care facilities. Finally, women are less active than men and although the latter spend more time on MVPA, they also spent more time in SB.

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